16. *Two Ships Problem:* At time $t = 0$ h, a freighter is at the point (90, 10) to the east-northeast of a lighthouse located at the origin of a Cartesian coordinate system, where x and y are distance in miles. At time $t = 2$ h, a Coast Guard cutter starts from the lighthouse to intercept the freighter. Figure 1-5l shows the graph of these parametric equations representing the ships' paths:

Freighter: $x = 90 - 10t$ Cutter: $x = 8(t - 2)$
$y = 10 + 5t$ $y = 10(t - 2)$

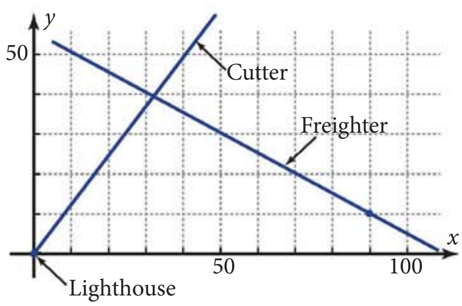

Figure 1-5l

a. Find the value of t at which the y-values of the two paths are equal. At this value of t, are the two x-values equal?

b. Do the two ships arrive at the intersection point at the same time? If so, how can you tell? If not, which ship arrives at the intersection point first?

For Problems 17–28, plot the function in the given domain using parametric mode. On the same screen, plot the inverse relation. Tell whether the inverse relation is a function. Sketch the graphs.

17. $f(x) = 2x - 6 \qquad -1 \le x \le 5$

18. $f(x) = -0.4x + 4 \qquad -7 \le x \le 10$

19. $f(x) = -x^2 + 4x + 1 \qquad 0 \le x \le 5$

20. $f(x) = x^2 - 2x - 4 \qquad -2 \le x \le 4$

21. $f(x) = 2^x \qquad x$ is any real number.

22. $f(x) = 0.5^x \qquad x$ is any real number.

23. $f(x) = -\sqrt{3 - x} \qquad -6 \le x \le 3$

24. $f(x) = \sqrt[3]{x} \qquad -1 \le x \le 8$

25. $f(x) = \dfrac{1}{x - 3} \qquad -2 \le x \le 8$

26. $f(x) = \dfrac{x}{x + 1} \qquad -6 \le x \le 4$

27. $f(x) = x^3 \qquad -2 \le x \le 1$

28. $f(x) = 0.016x^4 \qquad -4 \le x \le 5$

For Problems 29–32, write an equation for the inverse relation by interchanging the variables and solving for y in terms of x. Then plot the function and its inverse on the same screen, using function mode. Sketch the result, showing that the function and its inverse are reflections across the line $y = x$. Tell whether the inverse relation is a function.

29. $y = 2x - 6$

30. $y = -0.4x + 4$

31. $y = -0.5x^2 - 2$

32. $y = 0.4x^2 + 3$

33. Show that $f(x) = \frac{1}{x}$ is its own inverse function.

34. Show that $f(x) = -x$ is its own inverse function.

35. *Cost of Owning a Car Problem:* Suppose that you have fixed costs (car payments, insurance, and so on) of \$500 per month and operating costs of \$0.40 per mile you drive. The monthly cost of owning the car is given by the linear function

$$c(x) = 0.40x + 500$$

where x is the number of miles you drive the car in a given month and $c(x)$ is the number of dollars per month you spend.

a. Find $c(1000)$. Explain the real-world meaning of the answer.

b. Find an equation for $c^{-1}(x)$, where x now stands for the number of dollars you spend instead of the number of miles you drive. Explain why you can use the symbol c^{-1} for the inverse relation. Use the equation of $c^{-1}(x)$ to find $c^{-1}(758)$, and explain its real-world meaning.

c. Plot $f_1(x) = c(x)$ and $f_2(x) = c^{-1}(x)$ on the same screen, using function mode. Use a window with $0 \le x \le 1000$ and use equal scales on the two axes. Sketch the two graphs, showing how they are related to the line $y = x$.